CLAIMS

1. A method for applying a polymer coating to a surface of a glass substrate, comprising:

first, applying atmospheric plasma to the surface in order to clean and functionalize the surface;

second, applying a film of polymerizable liquid to the surface; and

third, curing the film by exposing it to high-energy radiation.

2. The method of Claim 1, wherein said first step further comprises:

supplying a plasma gas through a plasma head carrying a positive electrode and a negative electrode, wherein the plasma gas is supplied from a location between said electrodes.

3. The method of Claim 2, wherein said step of supplying a plasma gas further comprises:

supplying said plasma gas by diffusion through a porous metal emitter.

4. The method of Claim 2, wherein said step of supplying plasma gas further comprises:

supplying said plasma gas by diffusion through a porous ceramic emitter.

5. The method of Claim 2, wherein said step of supplying a plasma gas further comprises:

supplying said plasma gas through a plasma head including:

a central electrode having a polarity chosen between positive or ground;

a dielectric emitter laterally surrounding the central electrode and emitting the plasma gas; and

an annular outer electrode laterally surrounding the dielectric emitter and having a polarity chosen between positive or ground, opposite from the chosen polarity of said central electrode;

wherein the central and outer electrodes create a plasma discharge between them, and the dielectric emitter delivers plasma gas into the plasma created between the electrodes.

6. The method of Claim 2, wherein said step of supplying a plasma gas further comprises:

supplying said plasma gas through a plasma head including:

an elongated porous metal emitter, emitting the plasma gas;

a first elongated tubular electrode disposed in a parallel position to said emitter, offset to a first lateral side of the emitter, and connected for positive electrical polarity;

a second elongated tubular electrode disposed in a parallel position to said emitter, offset to a second lateral side of the emitter opposite from said first elongated electrode, and connected for ground electrical polarity;

wherein the first and second electrodes create a plasma discharge between themselves, and the porous emitter delivers plasma gas into the plasma created between the electrodes.

7. The method of Claim 1, wherein said second step further comprises:

applying a polymerizable liquid that produces a thermoset amorphous film when cured.

8. The method of Claim 1, wherein said second step further comprises:

applying a polymerizable liquid selected from the group consisting of acrylate, methacrylate, epoxy, polyurethane, vinyl components, and mixtures thereof;

a photo initiator; and

an ultraviolet stabilizer.

9. The method of Claim 1, wherein said second step further comprises:

applying a polymerizable liquid containing polyurethane diacrylate, tripropyleneglycol diacrylate, trimethylolpropane triacrylate, an adhesion promoter, and a photo initiator.

10. The method of Claim 1, wherein said second step further comprises:

applying a polymerizable liquid in quantity sufficient to establish a cured film having a thickness of at least 0.004 inches.

11. The method of Claim 1, wherein the surface of the glass substrate is the convoluted peripheral surface of an automobile windshield, and wherein said first step further comprises:

applying atmospheric plasma to a peripheral portion of said windshield by mechanically guiding relative movement on three axes between the windshield and a plasma head delivering plasma, such that:

said plasma head follows the convoluted peripheral surface of the windshield; and

the plasma head maintains a substantially uniform spacing from the windshield at the convoluted peripheral surface.

12. A plasma head for treating a preselected width of a glass windshield, comprising:

a base carrying a first dielectric tube and a second dielectric tube, each of a predetermined length and mutually parallel, wherein said predetermined length is the preselected width of glass windshield for treatment;

a positive electrode extending longitudinally within the first tube;

a ground electrode extending longitudinally within the second tube; and

an elongated emitter carried between the first and second tubes;

wherein said base at least partially defines a diffusion chamber in gas communication with said emitter and containing a plasma gas; and

a supply of plasma gas feeding the diffusion chamber.

13. The plasma head of Claim 12, wherein said emitter comprises an elongated strip of porous metal, parallel to said first and second tubes, diffusing plasma gas from said diffusion chamber.

14. The plasma head of Claim 13, wherein:

said positive and ground electrodes discharge a plasma between them; and

said porous emitter emits a plasma gas into the plasma.

15. A plasma head for treating a preselected width of a glass windshield with plasma, comprising:

a central electrode having a polarity chosen between positive or ground;

a dielectric emitter laterally surrounding the central electrode and emitting a plasma gas; and

an annular outer electrode laterally surrounding the dielectric emitter and having an opposite polarity from the central electrode;

wherein the central and outer electrodes create a plasma discharge between themselves, and the dielectric emitter delivers plasma gas into the plasma discharge created between the electrodes.

16. The plasma head of Claim 15, wherein said emitter comprises a porous dielectric layer, diffusing plasma gas while insulating said central electrode from said outer electrode.

17. The plasma head of Claim 15, further comprising a dielectric layer laterally surrounding said outer electrode.